Titration and standardisation abstract biology essay

Science, Biology

Abstract:

In this experiment, titration technique was used to detect the equivalence point of sodium hydroxide (NaOH) and acetic acid. Many steps were applicable in measuring and equalising the standard solution, but the main steps were measuring the oxalic acid as the standard solution; pouring the phenolphthalein, the indicator; and finally, titration of the solution until the first colour change. Initial and final reading of the volume of the quantitive results of sodium hydroxide was recorded in every each trial. In actual experiment of equilising of NaOH, the average titre volume delivered was 16. 13mL or 0. 0163L. In determining the moles of NaOH per average, it was found to be 0. 0032108 mol. based on the formula (moles NaOH per average titre divided by average titre volume delivered) given the Concentration of NaOH was found to be 0. 1990576 mol/L. Moreover, titrating acetic acid's average was found by dividing three result of delivered volume which is 18. 03mL (actual result of experiment). Experiment also found the value of the average titre of NaOH in moles by multiplying average titre volume delivered to concentration of NaOH that is 0. 19010576 mol/L. Since the results was found it was able to determine the Moles of Acetic acid in 20. 0mL of Vinegar and it was determine as 0. 003589 mol. The molarity of acetic acid in vinegar was found, the result was 0. 17945 mol/L. This technique was essentials for chemistry due to its ability to identify the concentration of an unknown solution despite of outliers such as incorrect number of measurement, inaccuracy of measurements and precision to replicate and miscalculate or mathematical error in accuracy of the measurements in level of correctness recording the measurements.

Introduction:

This kind of experiment was conducted in order to analyse, identify and determine the molarity of concentration of unknown solution. Specifically, is to identify the measurements and odds of different concentration of acetic acid in vinegar using the titration technique. Measuring using laboratory instrument is recommended, to identify the accuracy of the results, such as burette which is used to identify the measurement of the sodium hydroxide which is prerequisite in neutralising the vinegar completely. These steps are gently pouring in one solution in burette to another until the reactions between two compounds are complete and this called titration. Titration is a chemist's procedure in laboratory in order to measure and identify the molarity of a solution, and also controlled addition of solution from a laboratory instrument (burette) into a measured volume of a sample solution. Volumetric analysis is specified as equalisation the latter solution and any process of analysing quantity of chemicals in measuring volume sample of standard chemical solutions. One of the examples of volumetric analysis is Titration. Why? Because involving the accuracy and precision of volume measured of a sample analysed. The type of titration carried out is acid base titration using oxalic acid dehydrate and sodium hydroxide. In an acid-base neutralization reaction, an acid reacts with a base to produce water and a salt: HO2C-CO2H. 2H2O + 2NaOH (aq) ⇒ 4H2O (l) + Na+-O2C-CO2- Na+ (aq) (1)The protons (H+) from the acid react with the hydroxide ions (OH–) from the base to form the water. The salt forms from the caution from the base and the anion from the acid. Because water is always formed, acids will always react with bases; whether the salt is soluble or insoluble does not determine whether the reaction occurs. The reaction between acetic acid, $HC_2H_3O_2$ (aq), and sodium hydroxide, NaOH (aq), is shown below: CH_3CO_2H (aq) + NaOH (aq) ⇒ H_2O (l) + Na^+ $CH_3CO_2^-$ (aq) (2)When carrying out an acid-base neutralization reaction in the laboratory, you observe that most acid solutions and base solutions are colorless, and the resulting water and soluble salt solutions are also colorless. Thus, it is impossible to determine when a reaction has occurred, let alone when it is complete. To monitor the progress of a neutralization reaction, you use an acid-base indicator, a solution that changes color depending on the pH (or acid-content) of the solution. One commonly used indicator is phenolphthalein, which is colorless in acidic and neutral solutions and pink in basic (or alkaline) solution. During a titration, the indicator is added to the solution being titrated (the analyte). The titrant (or standard) is slowly added to the analyte until the endpoint, when the indicator changes color, signaling that the reaction between the two is complete. Phenolphthalein turns pink only when excess sodium hydroxide.

Materials and methods:

As per pages 23-25, SCI 105 Practical Manual 2013.

Results:

Preparation of Oxalic acid dehydrate standard

Mass $HO_2C\text{-}CO_2H. 2(H_2O)$ (in grams) =

1. 092 g

Now calculate the moles (n1), of HO2C-CO2H. 2(H2O)Mass used divided by the molecular weight, (126. 07 g/mol).

Moles of HO2C-CO2H. 2(H2O), n1 =

1. 012 g÷ 126. 07 g/mol

n1 =

0. 00803 molNow calculate the concentration (c), of HO2C-CO2H. 2(H2O) in 100. 0 mL. Concentration is moles (n), divided by volume(v),(c1 = n1 ÷ v ; where v = 0. 1000L)

Molarity of HO2C-CO2H. 2H2O solution, c1

0. 00803 mol ÷ 0. 1000L

c1 =

0. 08027 mol/LNow calculate the moles (n2), of HO2C-CO2H. 2(H2O) in 20. 0 mL. Moles is concentration times volume, (n2 = c1 x v ; where v = 0. 0200L)

Moles of HO2C-CO2H. 2H2O in 20. 0 mL, n2

0. 08027 mol/L x 0. 0200 L

n2 =

0. 0016054 mol

Standardization of NaOH

NaOH titretrial numberInitial volume(mL)Final volume(mL)Delivered volume(mL)150341625033. 916. 135033. 716. 3Average titre volume delivered, v1, (mL) = 16. 13 mLThe ratio of NaOH to HO2C-CO2H. 2H2O by equ. 1 is 2: 1. The moles of NaOH (n3) required is 2 times the moles (n2) of HO_2C-CO_2H. $2H_2O$ in the aliquot.(n3 = 2 x n2)

Moles NaOH per average titre, n3 =

0. 0032108 mol

Discussion:

Titration is a standard chemistry laboratory method measured volume of a solution of unknown concentration and also known as for determining unknown molarity or the number of moles of a substance given. The experiment is aiming for chemical reaction that can cause physical changes has been reached at the end point. In this experiment, the sample is oxalic acid and acetic acid as acid substance and sodium hydroxide as the base where the concentration of sodium hydroxide was unknown. The indicator that was used was phenolphthalein. Base was used as titrant that it will turn to light pink when a reaction reached its endpoint. Therefore, the concentration of the sodium hydroxide in 0. 01613 L of oxalic acid solution was 0. 1990576 mol/L and thus acetic acid concentration in 0. 01803 L of sodium hydroxide solution was 0. 17945 mol/L which is greater and lesser than the actual concentration NaOH and acetic acid, respectively. In this experiment, there were some mistakes that we encounter like the volume of acid is more than to titrate solution. The volume has passed the end point, so the volume use is much more than needed. To overcome this problem, we have to titrate slowly and shake the volumetric flask for about 30 seconds when the solution starts to change in color from colorless to light pink. The other reason is using of the volumetric flask that’s had been used with other solution. Therefore, the concentration of new solution is affected. To overcome this problem, we must make sure the volumetric flask is totally clean and dry. That’s why our result is not precise and accurate to the correct value.